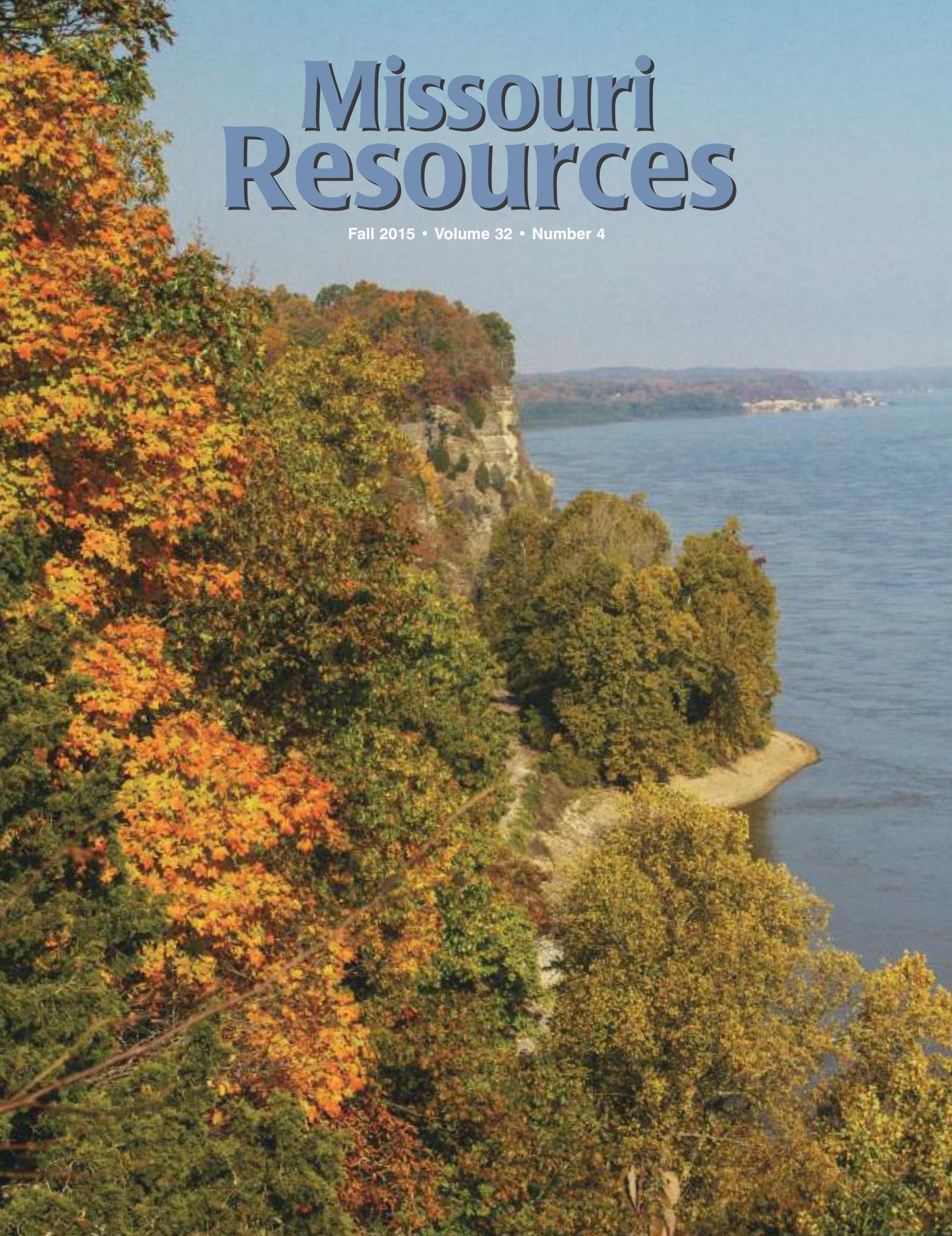


Missouri Resources

Fall 2015 • Volume 32 • Number 4



director's comment



The Missouri River is a vital resource for the state of Missouri. It flows approximately 553 miles through the Show-Me State before it joins the Mississippi River in St. Louis at Edward "Ted" and Pat Jones-Confluence Point State Park. Nearly half of all Missourians receive their drinking water from the river. The river is also crucial to our state for the power generation, water supply, river commerce, fish and wildlife habitat and the recreation it provides.

Many floaters or anglers may not immediately think about navigating the Missouri River when planning their next weekend out on the water – but don't dismiss the Mighty Mo too quickly. The Missouri River offers an opportunity to paddle through history with help from the recently dedicated Missouri River Water Trail. The Missouri Department of Natural Resources and its Missouri State Parks, Department of Conservation and the Division of Tourism launched the website last year to showcase the beauty of paddling the Lower Missouri River.

Paddlers will find information for planning everything

from simple day trips to multi-day expeditions at missouririverwatertrail.org.

The website uses a familiar Google maps interface to help users locate river access points, determine driving directions, explore additional services such as lodging, camping, grocery stores, restaurants, along with myriad amenities close to the river.

A truly unique aspect of the Missouri River Water Trail is the synergy with Katy Trail State Park, which follows the river for more than 200 miles, as well as several other Missouri state parks and historic sites located along the river.

With a little planning, you can cycle on Katy Trail State Park back to your car after a trip paddling down the river. Don't forget to log your Missouri Blue Miles as part of Governor Nixon's 100 Missouri Miles Challenge. Visit 100missourimiles.com to learn more.

Learn more by reading about the history of The Big Muddy, as well as, Missouri State History Flows on its Great River, in this issue of Missouri Resources. I hope to see you on the Missouri!

Sara Parker Pauley
Missouri Department of Natural Resources

Missouri Resources

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Mission Statement

The mission of the Missouri Department of Natural Resources is to protect our air, land and water; to preserve our unique natural and historic places; and to provide recreational and learning opportunities for everyone.

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2 The Big Muddy A Timeless Resource

by Joe Gillman

The Missouri River has provided life-sustaining water for millennia. We might be surprised that its massive watershed drains nearly one-sixth of the United States. Protecting this resource today will benefit future generations of Missourians and their neighbors.

6 From Eyesore to Asset Rural Brownfield Sites Going Back to Work

by Larry Archer

It can be a tall order to restore an environmentally contaminated property back to appropriate health standards. In rural settings, the issues are challenging due to smaller tax bases and magnified when the site must be passed over for a less desirable alternative.

12 Missouri State History Flows on its Great River

by Tom Uhlenbrock

In 1804, 35 years after the founding of St. Charles, Lewis and Clark met in that fledgling river town to plan their historic expedition. That same trip today boasts many reminders of just why the Missouri River meant so much to so many – and still does today.

departments

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Above: The Lewis and Clark Interpretive Plaza at Lewis and Clark State Park in southwest Buchanan County.

Front Cover: The Mississippi River as viewed from the overlook at Trail of Tears State Park in Cape Girardeau County.

Back Cover: The Mayhan family, Claysville, enjoys a walk on the Katy Trail in Callaway County. *DNR photos by Ben Nickelson.*



THE BIG MUDDY

A TIMELESS RESOURCE



by **Joe Gillman**
Director, Missouri Geological Survey

Affectionately referred to by many as the “Wide Missouri,” “Mighty Mo” and “Big Muddy,” the Missouri River has provided life-sustaining water for millennia. Water has always been a valuable resource, and Missourians are fortunate to have access to the Missouri River.

The Louisiana Purchase

When the United States acquired the Louisiana Territory from France in 1803, very little was known about the land that stretched from the Mississippi River in the east to the Rocky Mountains in the west. Eager to establish a presence in the new territory, in 1804 President Thomas Jefferson

commissioned Meriwether Lewis and William Clark to lead the Corps of Discovery on an expedition to the Pacific Northwest. The U.S. interests were both scientific and commercial – study the geography, geology and biology, and establish a trade route to the Pacific through the then Oregon Territory. This epic journey started in St. Louis on the Missouri River and ended on the Pacific coast.

The Big Muddy - Present-day

The modern Missouri River courses from the Rockies across the Great Plains, eventually emptying its contents into the Mississippi River and Gulf of Mexico. Along the way, it picks up and transports large quantities of silt-sized sediment deposited by the glaciers. As the powerful river slowly erodes at the soft sediment of the Plains states, this material becomes suspended in the water column, giving the river that characteristic muddy look.

Watershed

The Missouri is the longest river in the U.S. and combines with the Jefferson and Mississippi rivers to make up the world's fourth largest river system. A watershed is an area of land that drains water into a particular river, lake or wetland. Watersheds can be divided into smaller watersheds such as an area surrounding a specific small creek or stream. The Missouri River has a drainage area of 529,000 square miles (about one-sixth of the U.S.) and drains parts or all of Montana, Wyoming, North Dakota, South Dakota, Nebraska, Colorado, Kansas, Minnesota, Iowa, Missouri and two Canadian provinces. The river flows approximately 2,350 miles from its headwaters at the confluence of the Gallatin, Madison and Jefferson rivers in western Montana to its confluence with the Mississippi River near St. Louis, Mo.

Life-sustaining Water

The Missouri River has sustained many societies. Native cultures utilized the river as a source of navigation, food supply, trade and shelter. Upon European settlement, the Missouri provided one of the main corridors of westward expansion of a growing nation seeking riches in the fur trade and gold discoveries. As the population expanded and permanent communities were established, control of the river was needed for a variety

of purposes. Numerous dams were constructed along the river for power, to control flooding, and to assist agriculture.

Later, in response to repeated flooding along the river and continued pressures for utilization of water resources, Congress passed the Flood Control Act of 1944 allowing several major dams to be constructed and managed by the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation.

Today, these dams form the Missouri River main stem system and provide benefits to the entire Missouri River basin for water supply, irrigation, navigation, recreation, power generation and flood control.

(Opposite page) The Missouri River provides 42.6 percent of Missouri's drinking water. DNR file photo
(Below) The Missouri River flows approximately 553 miles through Missouri, including Kansas City, Mo. and St. Louis. A key to success in managing the state's water resources is local participation within local watersheds. Learn more about DNR's "Our Missouri Waters Initiative" at dnr.mo.gov/omw/.



DNR file photo

Navigation and flood control are two important river uses the department advocates for on behalf of all Missourians.

Water Resources Center

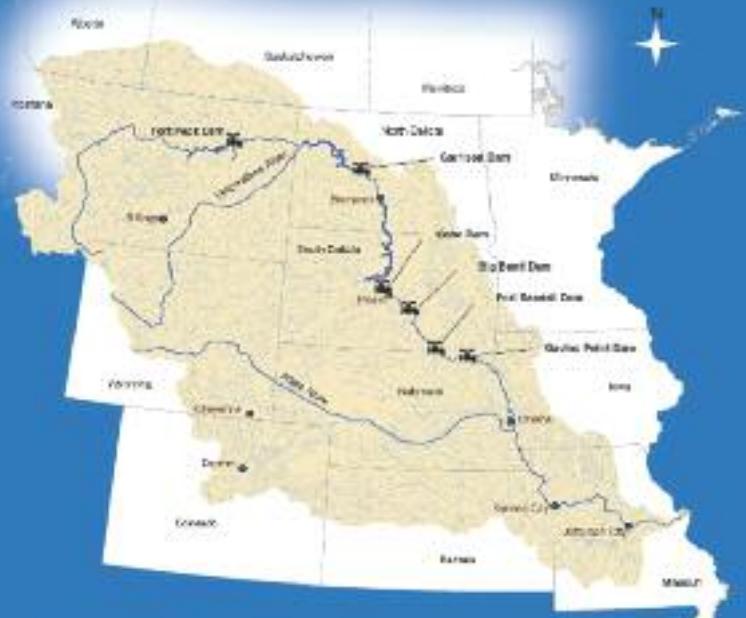
The Missouri Department of Natural Resources' Water Resources Center (WRC) is responsible for addressing the development, conservation and utilization of the state's water resources.

"Our staff members assist communities, public entities and state and federal agencies by providing expert technical assistance and guidance about issues such as interstate water management, drought and flood assessment, water resources planning and monitoring, statewide water use, instream flow recommendations and dam and reservoir safety," said Andrea Collier, the department's Water Resources Center director and a deputy director with the Missouri Geological Survey, a division of the Department of Natural Resources. "Staff are committed to ensuring the quantity of the state's water resources are maintained at the highest level practicable to support present and future use."

DNR file photo



Missouri River Basin Mainstem Reservoirs



Sources: U.S. Army Corps of Engineers, U.S. Geological Survey and Earth Systems Research Institute

All of the land that drains water into the Missouri River from Three Forks, Mont., to St. Louis, Mo., is referred to as the Missouri River Basin.

Access to Water for Missourians

Water is an extremely valuable resource and is critical to our state's prosperity. Missourians' interest in the Missouri River includes recreation, water supply, power generation, transportation and habitat for fish and game. According to the U.S. Geological Survey, the average discharge at Hermann, Mo. is a little more than 87,000 cubic feet per second. That is equal to approximately 39 million gallons every minute. Nearly half of all Missourians receive their drinking water from the river and its alluvium – the fine-grained soil consisting of mud, silt and sand formed by flowing water.

Increased demands on our water re-



DNR photo by Ben Nickelson

sources, such as its use in energy production and agriculture, underline the need to protect Missourians' access to adequate supplies of water from the river. As populations expand, the demand for water increases and more projects are likely to be proposed and developed.

Writing to his mother from Fort Mandan, N.D., March 31, 1805, Lewis observed, "This immense river so far as we have yet ascended, waters one of the fairest portions of the globe, not do I believe that there is in the universe a similar extent of country, equally fertile, well-watered, and intersected by such a number of navigable streams."

Much like the Corps of Discovery, the department recognizes the value of the Missouri River and continues to advocate on behalf of all Missourians so future generations of Show-Me State residents can depend on it.

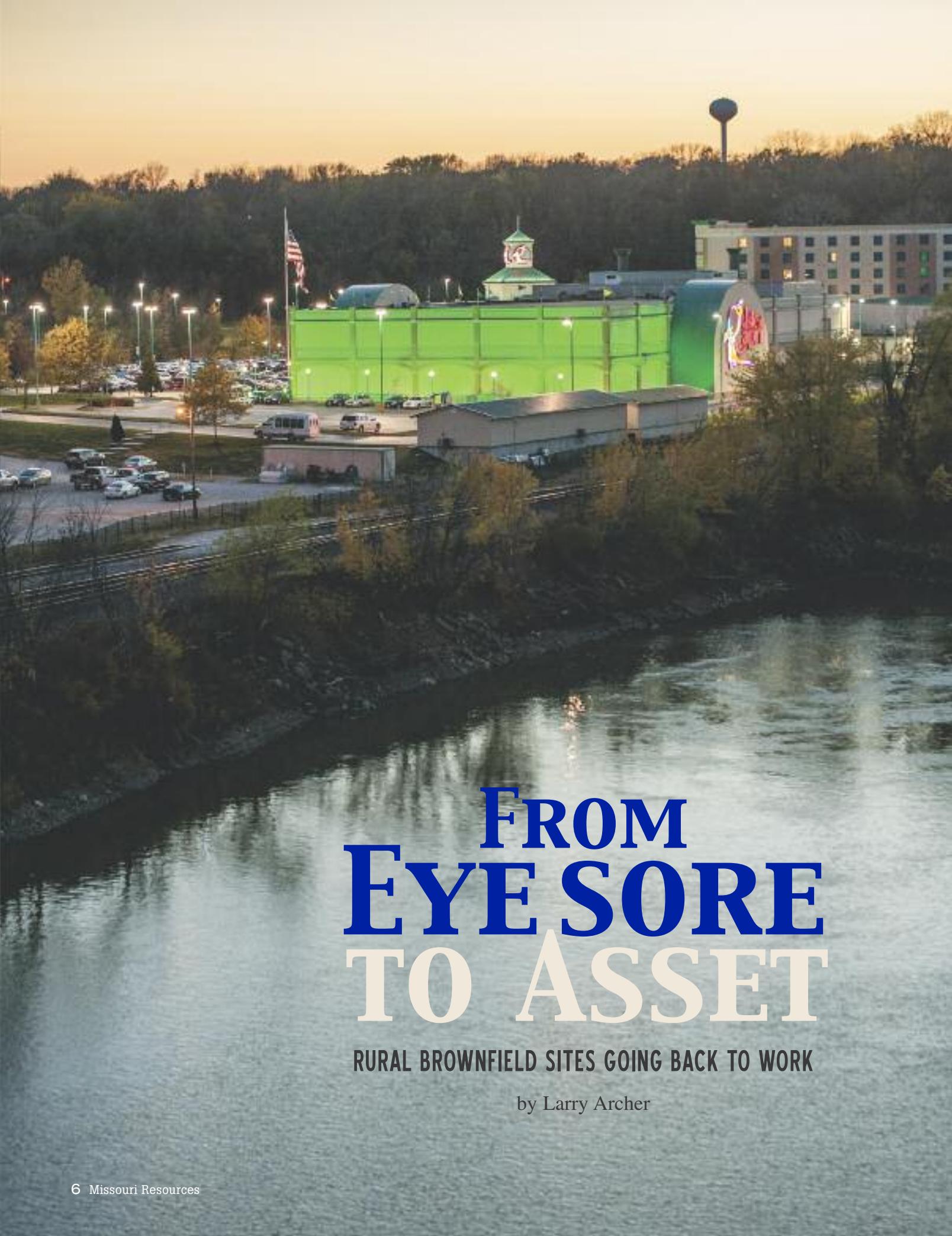
Learn more at dnr.mo.gov/env/wrc/interstate-waters/missouri_river.htm. 

(Top) Local levees, small canals, creeks and wetlands help minimize the damage done when the Missouri reaches flood stage, such as this channelized creek in central Missouri. On either side are multiple, expansive bottom-land tracts that support corn, soybeans and other important agricultural crops.

(Right) An interpretive trail leads directly to this point where the Missouri and Mississippi rivers merge, at Edward "Ted" and Pat Jones- Confluence Point State Park near St. Louis.



DNR photo by Tom Ullendorff



FROM EYE SORE TO ASSET

RURAL BROWNFIELD SITES GOING BACK TO WORK

by Larry Archer

For decades, the North Street Gas Station in the mid-Missouri town of California offered fuel and automotive services to motorists. But by 2006, it offered nothing but a vivid example of the negative effects an abandoned, potentially contaminated site can have on a community.

With trash at the site piling up on top of the ground, and uncertain contaminants lurking beneath, the location was sending the wrong message concerning the health and vitality of the city of California.

“It was a trash heap,” said Moniteau County Presiding Commissioner Kenneth Kunze, who would see the building daily on his way into the county courthouse. “It was an eyesore in the city.”

With its proximity to the courthouse, the corner lot held potential, but the possibility of residual contamination from its past as a service station caused concern for the county commission, Kunze said.

“When we decided to build a new jail, we thought that was a good location,” he said. “Our main concern ... was to make sure it was clean.

“If it were contaminated, we wouldn’t have done it.”

To ensure all they were buying was property and not future headaches born of a legacy of leftover contaminants, the commission reached out to the Missouri Department of Natural Resources’ Brownfields/Voluntary Cleanup Program to guide the effort to prepare the site for redevelopment by giving it an environmental clean bill of health, if appropriate.

“There was still the fear that there was contamination at the site,” said Christine O’Keefe, the department’s project manager for the site. “They wanted to conduct a Phase 1 assessment before they purchased the property.”

The Phase 1 assessment, which is a historical review of the site, includes a records review and interviews with neighbors and others who might be familiar with the site. The assessment determined that no additional cleanup was necessary for the site to

be redeveloped, keeping the \$3.2 million project on track.

“It’ll be a great improvement from what it was,” Kunze said of the new jail prior to its opening in March 2013.

The story of North Street Gas Station – and its transformation from eyesore to asset – is one of more than 60 such stories outlined in the Department of Natural Resources report: “Hidden Treasures: Rural Roots.”

The report highlights cases where brownfields – defined as properties whose future use is impeded by the presence or potential presence of a hazardous substance, pollutant or contaminant – in rural Missouri have been investigated and actions taken to prepare them for redevelopment. The report is available online at dnr.mo.gov/env/hwp/docs/2011ruralroots-bvcp.pdf.

This study reviewed sites in rural areas

“THE DEGREE OF CLEANUP DEPENDS ON THE LIKELY FUTURE USE.”

– Christine O’Keefe, DNR Environmental Specialist

whose owners chose to assess and, where necessary, clean up their properties through the Brownfields/Voluntary Cleanup Program. All of the sites successfully completed the investigation and remediation process. Remediation can range from a complete removal of the contaminated soil or groundwater to covering the area of concern so that it will not be disturbed in the future. “The degree of cleanup depends on the likely future use,” O’Keefe said.

“If your current use is a parking lot, and your future use is a daycare, you’d use the most conservative cleanup levels,” she said.

The projects were located in communities ranging in size from Baring, population 159, to Sedalia, population 20,339. An earlier study, issued in 2006, assessed the impact of addressing brownfields in the state’s urban areas.

The effects brownfields have on communities are similar regardless of size, but they

The Isle of Capri Casino, which has had a significant effect on the economy of Boonville, was developed on a 30-acre site that originally consisted of commercial, industrial and residential properties. The cleanup of the site included the excavation and disposal of 4,254 tons of contaminated soil. DNR file photo



DNR photo

Branson Landing, an upscale redevelopment project consisting of shopping and dining establishments in Branson, was made possible following cleanup efforts to address asbestos and other issues related to the older building that had previously occupied the site.

are magnified in rural communities whose population and employment base is smaller. The report outlines some of the negative effects: “Properties with hazardous substance contamination have significant effects upon their communities. Contaminated properties are a blight on the spirit and economy of a community, and may represent threats to both human and environmental health,” according to the study. “Both the negative effects of a brownfield property and the positive influence of its cleanup and redevelopment have a greater proportional effect on a smaller community than in a large city.

“In all cases, the public health exposure has been reduced and the brownfield has been removed from the community,” the study went on to state.

As with the case of the North Street Gas Station in California, many sites require only a Phase 1 assessment to determine whether the site is suitable for continued redevelopment.

However, one project highlighted in the brownfields redevelopment study required some additional work in order to convert a site in Lebanon, Mo., into a new business employing more than 30 people.

The national pharmacy chain Walgreens had identified the corner of Jefferson and East Elm in Lebanon as an ideal store location, but the site’s past, which included gas stations and a car dealership, was troubling.

“It’s their policy to have a clean piece of property before they begin,” said Chris Cady, the department’s project manager who oversaw the certification process. Investigations indicated the site still possessed an underground fuel storage tank and soil contaminated with heating oil, hydraulic fuel and gasoline. Removal of the tanks, related piping and contaminated soil was required for the project to continue.



DNR photo



(Top) Investigations performed at the site of the prospective Walgreens in Lebanon determined that abandoned underground storage tanks associated with an old gas station at the north corner of the property would require removal before the site could safely be used. The tanks were removed along with piping and contaminated soil.

(Above and right) A former electric generation facility, the nearly 100-year-old Hermann Electrical Light Plant has been converted to a local museum. The museum is part of a larger redevelopment that includes an amphitheater, performing arts center and a local hiking and biking trail.



after



Once the location of a manufactured gas plant, this site near A.T. Still University in Kirksville required the removal of several thousand tons of contaminated soil, debris and coal tar before it could safely be converted into a parking lot for the university. The site also is subject to a management plan to ensure proper handling during any future construction.

“Determining the location of a new store depends on demographics, including future growth, demand and competition,” according to Emily Hartwig of Walgreen’s media relations office. “However, environmental uncertainty can affect the cost of developing a site and the final decision of where to locate a store.

“Having a clean bill of health positively impacts the overall cost of the project and lowers the cost of the operation of the store,” Hartwig said. “The severity of remediation needed could make it financially prohibitive to pursue a particular property.”

In addition to converting blight to business, projects like the Walgreens development also aid the bottom line of local coffers, according to Mark Stombaugh, president of Lebanon Regional Economic Development Incorporated (REDI).

“What wasn’t a productive property is now spitting out all sorts of sales tax revenue,” Stombaugh said of the remediated Walgreens site.

Stombaugh and Lebanon REDI are work-

ing with the department on other sites through the Brownfields/Voluntary Cleanup Program, and recognize the potential effect on local tax revenue.

Bringing in new business is only half the economic benefit of addressing brownfields in the rural community. The other half involves retention of existing employers, the report noted.

“Over half of the sites continue to serve the current business owner, which in turn helps keep them in business, keeps local people employed, and keeps bringing tax revenue to the community,” the study reported. “Retaining businesses in rural communities is an important economic development tool in the quest for sustainable development.”

Similarly noted in the report was the fact that the effects do not end with the economics. Addressing these issues also increases the aesthetic value of the property and helps allay the health and environmental concerns held by those who work and live near the sites.



before

DNR file photo



after

The nature and size of the projects featured in the report vary greatly. In Branson, two brownfields project completions cleared the way for the development of Branson Landing, an upscale shopping, dining and entertainment venue, as well as the nearby Branson Convention Center.

Meanwhile, in the town of Purdy in nearby Barry County, the identification and removal of contaminants from a former gas station site on property used by Alltel, a telecommunications company, "paved the way" for pavement.

After being issued a certificate of completion, the company expanded its parking area at the site, benefiting residents in the community of 1,103.

A review of the 60 projects profiled in the report also illustrates that while the majority of such projects result in new or renewed commercial activity, many, like the jail in California, contribute to the community in non-commercial ways. In the north-central Missouri town of Macon, a former

auto salvage yard – after receiving a certificate of completion – was purchased by the city for use as a site for a wastewater treatment facility. In Troy, a former feed mill became the site of the county's new fire station, and in Hermann, a former power plant was transformed into a local museum.

Regardless of whether the final use is public or private, the report illustrates how the benefits are universal: "When cleaned up and reused, many of these blighted sites have proven to be hidden treasures whose worth is significantly increased. Environmental cleanups are a valuable part of the economic development process in Missouri's communities and play a vital role in creating and maintaining healthy communities for citizens to live, work, and play."

Concerned about the environmental past of the former North Street Gas Station in California, Mo., the Moniteau County Commission initiated an environmental investigation of the site. The investigation determined there were no risks to human health or the environment for current or future use of the property, clearing the way for the construction of the Moniteau County Jail.

Larry Archer is division information officer for the department's Division of Environmental Quality. Catherine Jones, author of Hidden Treasures: Rural Roots, contributed to this story. Jones is a planner in the division's Hazardous Waste Program.

Missouri State History Flows on its Great River

by Tom Uhlenbrock

The tale of human history in Missouri follows the great river that stretches across the state's middle. Traveling up this river takes visitors to state parks and historic sites that help tell the story.

When the French explorers Jacques Marquette and Louis Jolliet arrived at the confluence of the Missouri and Mississippi rivers north of St. Louis in 1673, they were told a tribe of Native Americans living on the muddy river that led west was called the Oumessourit.

The name translated to "people of the big canoes," and evolved into Missouria for the tribe, and to Missouri for the river and later the state that bordered its lower reaches.





DNR file photo

Our voyage upriver begins at **Edward “Ted” and Pat Jones-Confluence Point State Park**, the only spot where a visitor can put a foot in both of America’s great rivers. A short walk from the interpretive kiosk ends at the meeting of the waters.

Some 20 miles upriver, on the south side of a bend in the river, French traders in 1769 founded the city that would become St. Charles. Lewis and Clark met there in 1804 to plan their grand expedition.

The **First Missouri State Capitol State Historic Site** explains how a now restored brick building on the city’s South Main Street served as the first state capitol from 1821 to 1826, when the capital was moved to Jefferson City.

A German lawyer and writer named Gottfried Duden visited the lower Missouri River Valley and published a book about it in 1829 in his homeland. His glowing account of the area spawned a wave of immigration of Germans who founded towns from St. Louis to Boonville, with Augusta, Washington, Marthasville, New Haven and Hermann in between.

Deutschheim State Historic Site at Hermann, which retains its German heritage to this day, features two homes that display the German architecture and lifestyle, inside and out. The handsome Pommer-Gentner house was built in 1840, and was the first two-story brick home in town.

An excellent way to explore the lower river valley is at **Katy Trail State Park**, a linear recreational trail built on an abandoned rail line that stretches 240 miles, from Machens in St. Charles County to Clinton near Kansas City.

The Katy Trail, which celebrates its 25th anniversary in 2015, includes a 165-mile segment that follows the Missouri River from Machens to Boonville and is designated as part of the Lewis & Clark National Historic Trail.

The trail passes through Missouri wine country, where the German immigrants established their grape-growing and wine-making traditions.

After the seat of government moved upriver to Jefferson City, James A. Crump built a three-story, white-stone building in 1839 on the Missouri Landing, a block away from the state capitol.

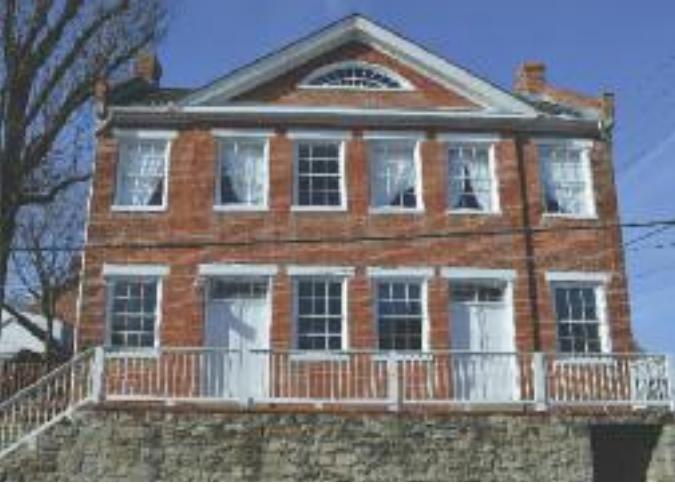
Charles Lohman later bought the building, which today is one of two that make up the **Jefferson Landing State Historic Site**. Displays inside the renovated building explain how it was a bustling commercial and transportation hub as the nation was beginning its move west.

Business declined after railroads bypassed Jefferson City in the 1870s, and the Lohman Building later was used for storage. Missouri State Parks recreated an

(Above) The “Big Muddy” and “Mighty Mississippi” merge into one near Manitou Bluffs, just north of St. Louis. **Edward “Ted” and Pat Jones-Confluence Point State Park** features outdoor interpretive exhibits about the history of the rivers and the role they played in the Lewis and Clark Expedition. Pictured here is the confluence prior to construction of the park’s present-day visitor access (see page 5). Unlike the page 5 photo, the photographer’s vantage point in this shot was reversed, putting the Mississippi on the right, and Missouri on the left.



DNR photos by Tom Uhlenbrook



(Top) The First Missouri State Capitol State Historic Site in St. Charles was Missouri's governing chambers from 1821 to 1826.

(Above) The Pommer-Gentner House at Deutschheim State Historic Site was the first two-story brick building in Hermann.

(Right) Missouri's American Indian Cultural Center at Van Meter State Park, Saline County, offers displays that interpret the cultural history of the nine tribes that called Missouri home in the early 19th century.

1850s general store in the lower floor of the building, which features a short movie to illustrate the area's history.

The Arrow Rock bluffs on the river west of Boonville first appeared on a French map in 1732 as "pierre a fleche" – the rock of

arrows. The area became known as Boone's Lick Country because the sons of the legendary pioneer Daniel Boone operated a salt-manufacturing business in the river valley in 1805.

A narrow, winding trail now leads to the site of the salt spring in the valley at **Boone's Lick State Historic Site**. Interpretive signs help you visualize the substantial frontier industry once located there.

A ferry was established at Arrow Rock in 1815, and the earliest travelers on the Santa Fe Trail crossed the river on it.

By the middle of the 19th century, Arrow Rock had grown to a small city of more than 1,000 residents. But railroads and highways replaced river travel, and

Arrow Rock declined to its present population of about 50 permanent residents.

Today, the **Arrow Rock State Historic Site** preserves the charming town as a step back in time with historic buildings and a modern visitor center. The J. Huston Tavern, built in 1834, still serves some of the best fried chicken in the state.



DNR photo by Ben Nickelson



DNR photo by Tom Uhlendorf

Van Meter State Park, on a bend of the Missouri where the Grand River enters, preserves the area where the Missouria lived at the time of Marquette and Jolliet. The Oumessourit Natural Area shows what the floodplain looked like before the river was channelized and constricted by levees.

The last full-blooded Missouria died in 1908. The park is home to the American Indian Cultural Center, which has exhibits that tell of the Missouria and the eight other tribes that lived in what became the state of Missouri.

The Missouri River heads north at Kansas City. Lewis and Clark arrived July 2, 1804, and recorded evidence of an old Indian village on the western side. The town of Weston was established in 1837 opposite Fort Leavenworth.

Weston Bend State Park has displays that tell how the town prospered, thanks to the tobacco and hemp trade. The McCormick Distillery began

operation in 1858 and claims to be the oldest continuously operated distillery in the United States.

Agriculture, including tobacco, still plays an important role in the area's economy. The park features an overlook with an expansive view of the Missouri River and its wild bottomland forests, similar to what Lewis and Clark found.

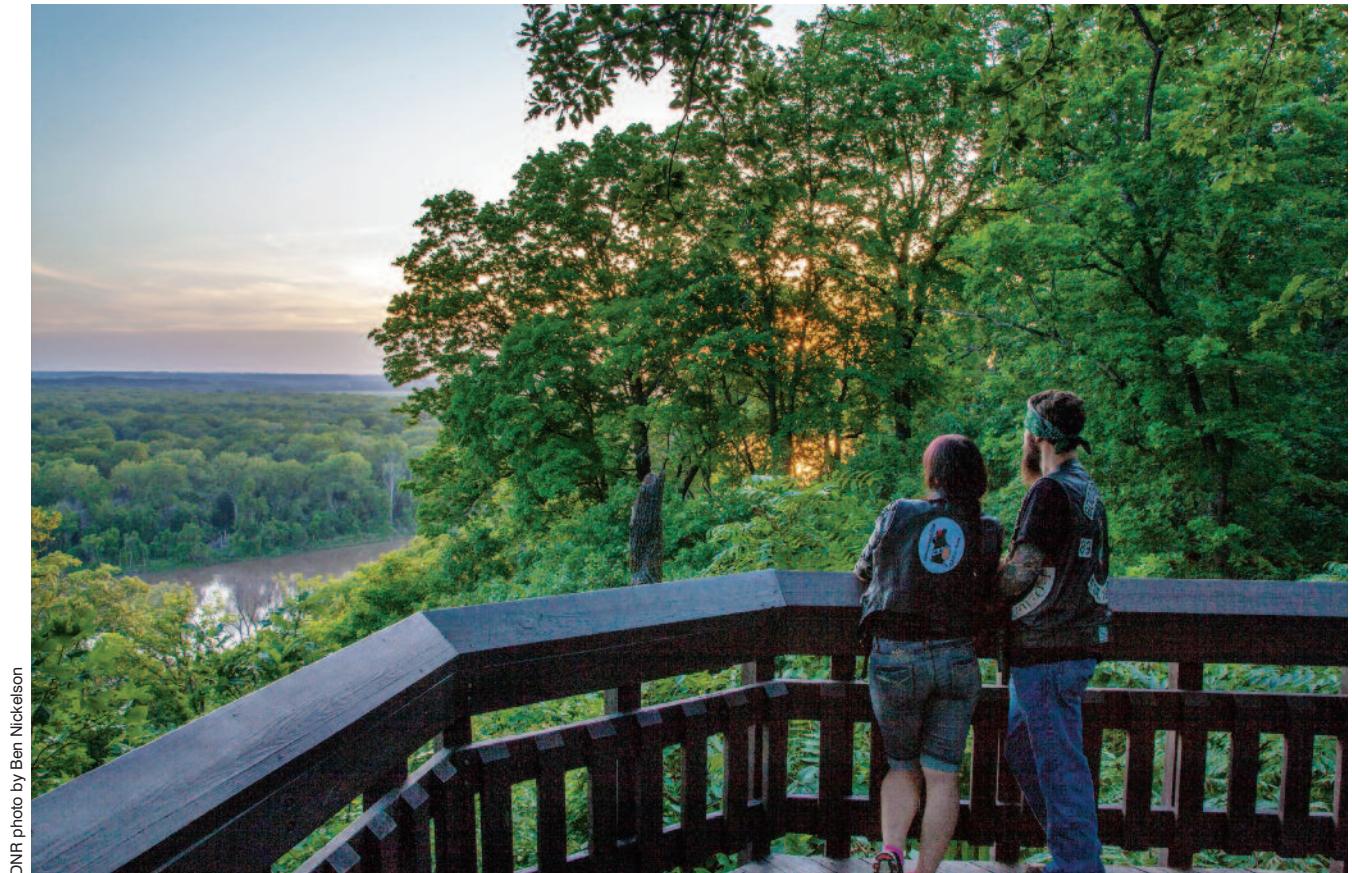
As the explorers headed north on the river, Clark recorded in his journal the dis-

(Above) This stretch of Katy Trail State Park near Rocheport was the first to be opened.

(Below) The Lohman Building on the Jefferson City riverfront was part of a bustling commercial and transportation hub that developed as the nation began its westward expansion.



DNR file photo



(Above) After a short walk to the overlook, visitors to Weston Bend State Park are rewarded with a beautiful view of the Missouri River Valley.

(Below) An estimated 500,000 snow geese visited Big Lake State Park in Holt County during winter 2014-2015.

DNR photo by Tom Uhlenbrock

covery of a lake “full of Geese & Goslings.” Today, the lake is the centerpiece of **Lewis and Clark State Park**.

The lake still draws waterfowl, especially during fall migration when its surface is crowded with geese, ducks, great blue herons, eagles, swans and snowy egrets.

Visitors can view the expansive nature show from the Lewis and Clark Bicentennial Plaza that includes a scenic overlook and interpretive materials.

Before they left the stretch of the river that bordered what became the northwest corner of Missouri, the explorers recorded other oxbow lakes that had been left behind when the Missouri changed its course.

Big Lake, the largest remaining oxbow lake in Missouri, would have attracted their attention.

Big Lake State Park is on the east side of the 625-acre lake, and acts like a magnet



to attract waterfowl migrating in the spring and fall over the agricultural fields.

Last winter, wildlife researchers estimated 500,000 snow geese, and nearly 100 bald eagles, were resting and feeding at the lake – the largest number ever recorded.

One of the great wildlife spectacles in Missouri in winter is the rising of the snow geese from the misty lake each morning in a whirling white tornado. Unlike the honking of Canada geese, snow geese have a screeching call that makes for an eerie cacophony in the silence of daybreak.

Like the Missouria and other first inhabitants, and the explorers and traders that followed them, the waterfowl use the Missouri River as their highway. If the weather at Big Lake grows cold, the snow geese will move south and may end up in the pools and wetlands near Confluence Point State Park.

For more information, visit mostateparks.com. 

Tom Uhlenbrock is a writer for Missouri State Parks.



DNR photo by Ben Nickelson

(Above) Bikers follow Katy Trail State Park along the Missouri River in Callaway County on a sunny fall day.

(Below) A reproduction of Lewis and Clark's keelboat can be viewed at Lewis and Clark State Park in Buchanan County.



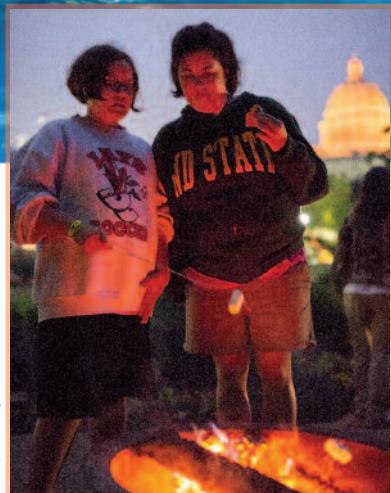
DNR photo by Ben Nickelson

CAMP OUT at the Capitol

by Tom Uhlenbrock



DNR photo by Ben Nickelson



DNR photo by Ben Nickelson



DNR photo by Ben Nickelson

Charlene Williams brought four excited teenagers, all rookie campers, to the Governor's Capitol Campout on May 30.

Chris Brooks, at 18 the oldest of the four, had the most experience.

"I camped out in my backyard once, but got scared with all the bugs crawling around and I had to go back to the house," he said.

Williams is a leader with "Teens of Tomorrow," a St. Louis group that gives a helping hand to young men who need it. Williams had one rule: They had to leave their cellphones and other electronic gadgets in the van.

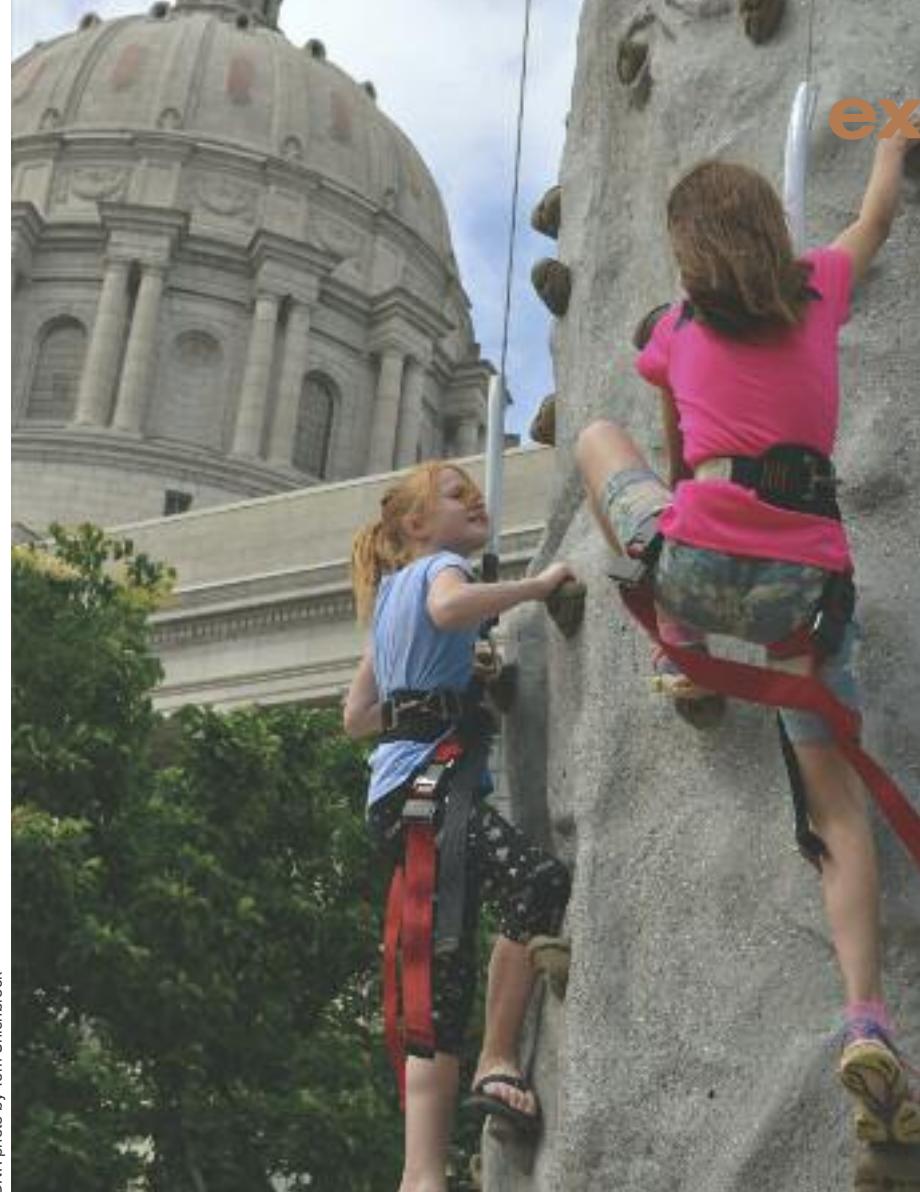
The boys took off their shoes at the door when entering the spacious tent, played card games and took the tour of the Missouri Capitol. They appreciated the old-fashioned fish fry, the cobbler made at the Mountain Man Rendezvous Village and s'mores and entertainment near the campfire.

Williams had one worry as evening arrived. She was sleeping in the tent with the boys, who were ready for ghost stories.

"Yes," she said with a laugh. "Pray for me."

The Governor's Capitol Campout was part of a national effort sponsored by the American Recreation Coalition. Governors in more than a dozen states took part, joining with their local park agencies in hosting campouts at their capitols or parks.

Gov. Jay Nixon and First Lady Georganne Nixon, along with their dog, Huck, greeted the 24 families participating in the event and told them



DNR photo by Tom Uhlenbrock

(Opposite page, top) Participants in the Governor's Capitol Campout had the opportunity to try various outdoor activities, including kayaking.

(Opposite page, inset) Campers make s'mores in the evening at the Governor's Garden.

(Opposite page, bottom) First-time campers were supplied with camping equipment and tent-pitching assistance from Missouri State Parks staff.

(Above) Guests try their hands – and feet – on a rock wall set up on the capitol lawn.

they were the first ever to camp out on the state capitol grounds.

"Thank you for coming out and helping us make history," the governor said.

Nixon said getting families to share the outdoors together has been a priority of his administration, pointing to the popular Governor's 100 Missouri Miles Challenge.

Derrick Crandall, president of the American Recreation Coalition, said the mission of his group is to get all Americans outdoors.

"One-third of America belongs to all of us – the state and national parks,

the national forests, the lands managed by public agencies – and not all people are using them," said Crandall.

"We want to make it easy for kids to have that first experience. If the first experience is a good one, they'll come back."

Bigger, Better Next Year

Sponsors of the event included the Missouri Department of Natural Resources, and its Missouri State Parks, the Missouri Department of Conservation, Bass Pro Shops and Wonders of Wildlife. The campout was held May 30 and 31 in conjunction with

Bass Pro Shops Outdoors Days at the Capitol. A variety of free activities, from kayaking to rock wall climbing to mountain biking and skateboarding on a rolling track, were set up in front of the capitol.

The families that signed up for the campout were chosen by Missouri State Parks and Bass Pro Shops after they expressed interest in learning more about camping. They were given tents, tarps, sleeping bags and ground mats. All of the camping equipment was donated by Coleman Co. and Bass Pro Shops.

Bill Bryan, director of state parks, said the goal of the campout was to provide a safe and supportive environment for families to learn basic camping skills.

"We know spending time outdoors makes you healthier and happier," Bryan said. "Some people have grown up camping and fishing; others haven't had that chance and may lack the confidence to get out there with friends and family."

"The event was such a success we've already committed to making it bigger and better next year."

Surviving Outdoors

Amy Tingue of Kansas City agreed it was a welcome experience for her son, Tyson, 8, whose only previous camping was in the backyard with his father. The two were snuggling in their tent, where Tyson had some personal items stashed in the corner.

"I brought some stuffed animals and wrestling guys," he said. "And a football."

Like Charlene Williams, who banned cellphones from her four teenage charges, Tingue said Tyson was not allowed to bring any of his electronic games.

"Someone had a meltdown this morning," she said with a smile. "But he's breathing, he survived."

For more information, visit mostateparks.com.

Tom Uhlenbrock is a writer for Missouri State Parks.

100 Missouri Miles Challenge Receives National Award

American Trails, a national, nonprofit organization working on behalf of the nation's hiking, biking and riding trails, has recognized Missouri with the Outstanding Media Award for the Governor's 100 Missouri Miles Challenge, an initiative launched by Gov. Jay Nixon in 2013.

The award was announced in May at the International Trails Symposium in Portland, Ore. The national award recognizes significant and sustained efforts to provide positive public expo-



sure and education in the field of trail use, planning, design, implementation or policies.

For more information and to take the challenge, visit MO.gov. Participants also can share adventures, post photos and learn about upcoming events by connecting with 100 Missouri Miles on Facebook and Twitter using #100MoMiles.

Pembroke Hill High School Wins Second National NCF-Envirothon

Held in Springfield July 27-Aug. 2, the national event saw Pembroke Hill High School take top honors for the second time, winning previously in 2012. The team also earned the top

score for aquatics, oral presentation and current issue, competing against 52 other teams from the United States and Canada.

"I'm so proud of the commitment the students of Pembroke Hill give to the Envirothon," said Judy Stinson, an environmental education specialist with the department's Soil and Water Conservation Program. "We were so pleased to have them represent Missouri," added Stinson, co-chair of the annual statewide Envirothon competition.

Envirothon is a natural resource competition sponsored by the Missouri Association of Soil and Water Conservation Districts, and the local soil and water districts. The Department of Natural Resources has been a

Time Exposures

The Grand Army of the Republic (G.A.R.) Ribbon Banner was created in 1936 by Marian Kornbleet, Secretary of the Missouri G.A.R. and presented to the National G.A.R. The banner is particularly significant for its inclusion of the G.A.R., Ladies of the Grand Army of the Republic (L.G.A.R.) and Woman's Relief Corps (W.R.C.) ribbons, which were used during the organizations' annual encampments. The ribbons date from as early as 1886 to as late as 1935 and are from groups across America.

The G.A.R. was founded in 1866. The initial intention for the organization was to provide benefits to Union veterans that served during the American Civil War, and their families. In addition to its advocacy work, the G.A.R. developed into a fraternal organization. Each annual encampment had multi-day events that included camping, formal dinners and memorials. The first encampment was held in Decatur, Ill. on April 6, 1886.

In 1888, there were 382 encampments in Missouri and numbers rose to more than 500 by 1893. There are at least two G.A.R. memorial sites in Missouri. One, located in Carthage in Park Cemetery, contains a granite monument. The other, located in Laclede at the corner of Grove and Cole streets, has a bronze statue dedicated to the Phil Kearny G.A.R. Post No. 19.

The quilt is one of approximately 30,000 artifacts in the Missouri State Museum's collection. The Missouri State Museum, which is a part of Missouri State Parks, houses its artifacts at the Riverside Collections Facility, a secured warehouse one mile east of the Missouri State Capitol building.



DNR photo by Andrew Richmond

Send your photo to "Time Exposures," c/o Missouri Resources, PO Box 176, Jefferson City, MO 65102-0176. Original photos will be returned via insured mail. Pre-1980 environmental and natural resource photos from Missouri will be considered. Please try to include the date and location of the picture, a brief description and any related historic details that may be of interest to our readers.

partner since 1998, when it held its first state competition. A feature story on the 2015 Envirothon will run in the winter issue of *Missouri Resources*.

Earth Science Week 2015



Earth Science Week aims to help the public gain a better understanding and appreciation for the Earth sciences

and to encourage stewardship of the Earth. This year's activities will be held Oct. 11-17 and will celebrate the theme "Visualizing Earth's Systems."

On National Fossil Day, Oct. 14, visitors to the Ed Clark Museum of Missouri Geology, in Rolla, will receive a crinoid fossil. Be sure to check out the fossils in the limestone of the Missouri State Capitol, as well.

Join millions in the Great Central U.S. ShakeOut "Drop, Cover, and Hold On" earthquake drill to be held Oct. 15 at 10:15 a.m.

Geologic Map Day is scheduled for Oct. 16 to promote the importance of geologic mapping.

Missouri Geological Survey geologists are sponsoring an educational booth Oct. 17 at the Ozark Mountain Gem and Mineral Society's Rock, Gem and Mineral Show, at the Expo Center in Springfield.

Go ahead – be a citizen scientist. Learn more at dnr.mo.gov/geology/education.htm.

Geologists Receive Publication Award



The Association of American State Geologists selected the Missouri Geological Survey, a division of the Department of Natural Resources, as the recipient of their 2015 Charles J. Mankin Memorial Award.

Mankin, the Oklahoma state geologist for more than 40 years, was world-renowned for his work in mineral and energy resources.

OUR MISSOURI WATERS

"No MOre" Trash Blitz in Lower Grand River Watershed

When litter is on the ground, it eventually winds up in our water. On April 11, 2015, agency and local community partners came together for the first Locust Creek "No MOre" Trash Blitz in the upstream portions of the Lower Grand River watershed.

More than 70 volunteers, including local youth organizations and several Adopt-A-Highway groups, gathered to pick up trash from local roadways. Volunteers in Linn County picked up trash along Highway 5 near Linneus and Locust Creek at Rocky Ford Access.

Volunteers in Sullivan County picked up trash in the East Locust Creek watershed. Planning for the event was a partnership of the Missouri departments of Natural Resources, Transportation, Conservation, the Stream Team Program, the local Highway 5 Corridor Coalition and the North Central Missouri Regional Water Commission. Local partners, including the Linneus United Methodist Church, Smithfield/Farmland Foods, North Central Missouri Electric Coop, Pepsi and local Walmart stores, helped provide lunch for volunteers.

By bringing together state agencies, local businesses and local volunteers, more than 5 tons of trash were removed from roadways and kept from entering our Missouri waters.



An Adopt-A-Highway group from Smithfield/Farmland Foods picks up litter in Milan, within the East Locust Creek watershed.

Danah Fowler photo



The Paleozoic Succession in Missouri, Part 1 (Revised) – Cambrian System, was authored by Justin G. Davis and Patrick S. Mulvany (MGS), James R. Palmer and Thomas L. Thompson (MGS, retired), and Kevin R. Evans, Vincent E. Kurtz, James F. Miller and John F. Repetski.

This highly detailed publication thoroughly investigates the Paleozoic stratigraphic succession and is considered the leading midcontinent guide for Paleozoic stratigraphic succession in the region.

The award will be presented in November in Baltimore, Md., in concert with the Geological Society of America's annual meeting.

"I congratulate the authors and the Missouri Geological Survey for producing a superb publication," said John G. Parrish, Ph.D., PG, AASG past-president and awards chair.

The award-winning publication is available for purchase at missourigeologystore.com/Paleozoic-Succession-Cambrian/.

For news releases on the Web, visit dnr.mo.gov/news.

For a complete listing of the department's upcoming meetings, hearings and events, visit the department's online calendar at dnr.mo.gov/calendar/search.do.

Looking for a job in natural resources?
Go to dnr.mo.gov/hr.

Top Spots to Backpack



(Above) Gregg and Sheila Buswell of St. Louis hike the Whispering Pines Trail at Hawn State Park with their dog, Luke.

(Left) The North Loop of the Whispering Pines Trail covers 6 miles of the 9.75-mile trail.

(Bottom) The Mudlick Trail takes backpackers up Mudlick Mountain and offers views of the Big Creek Valley in Sam A. Baker State Park.

DNR photos by Tom Uhlenbrock

Seventeen of Missouri's state parks offer opportunities for backpacking. Guests wanting to explore the wilderness of these state parks all day and night should plan to visit Hawn, Sam A. Baker, and Meramec state parks.

The Mudlick Trail, at Sam A. Baker State Park, climbs from 415 feet above sea level to more than 1,300 feet above sea level over some of the most rugged terrain in the St. Francois Mountains. Guests on the trail are given the opportunity to view and take pictures at some of the best sights the park has to offer, such as the cool waters of the St. Francois River and the Big Creek Valley. The length of the trail, beginning from the equestrian campground, is about 16.75 miles and takes an estimated 16 hours and 45 minutes to complete.

The 9.75-mile Whispering Pines Trail at Hawn State Park provides a mixture of hardwoods and pine forests, which is home to a variety of animals, such as bobcats and wild turkeys. Exposures of sandstone and granite are found and can be explored along the banks of Pickle Creek and the River Aux Vases. The trail is easy to navigate as it is signed in a counterclockwise direction with colored arrows; additional arrows lead to camping areas.

The Wilderness Trail is the longest trail in Meramec State Park, totaling 8.5 miles. Backpackers will have a good opportunity to experience the natural and geologic wonders of the park with an adventure on this trail. The route winds through the Meramec Upland Forest Natural Area, which is a rugged and remote area of the park. There are eight backpacking camps provided along the trail.

As with any lengthy backpacking trip, it is advised to come prepared and be ready for changing weather conditions.





Sheppard Point Trail

at Trail of Tears State Park

Mature forests, characterized by sharp ridges and steep ravines, cover much of Trail of Tears State Park. Located immediately adjacent to the Mississippi River, visitors can view the plentiful wildlife, including white-tailed deer, turkeys, hawks and foxes.

A great opportunity to experience the natural wonders of the park is the 3-mile Sheppard Point Trail, which features a distinctive forest type with an Appalachian flavor. Plant life includes American beech, cucumber magnolia and tulip poplar trees, as well as an understory with a rich growth of ferns and a rare parasitic plant called beech drops. Sheppard Point, a spot on top of an impressive bluff overlooking the Mississippi River, is a great place to view eagles, especially in the winter.

The trail ascends to the top of a ridge and heads toward the Mississippi River. From there, steep inclines provide impressive views from the edges of the ridge. The trail then drops off the ridge and loops down to a valley and back up a steep incline to Sheppard Point. The trail starts at the Greensferry Shelter area on Moccasin Springs Road.

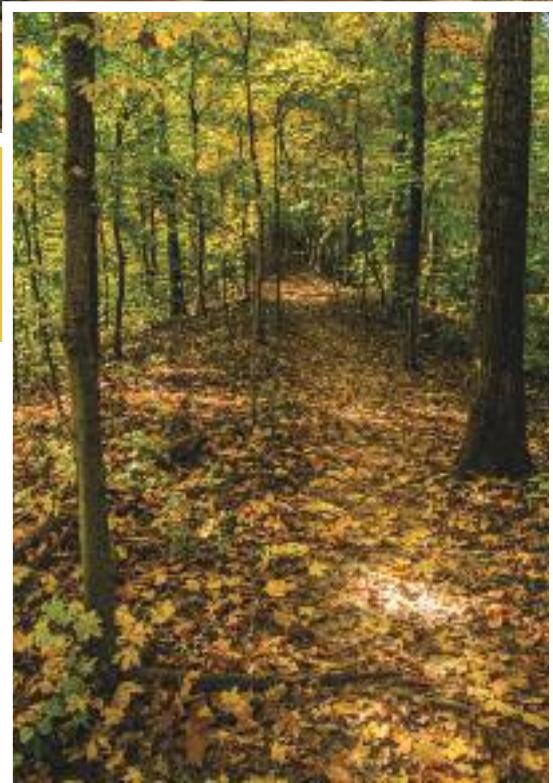


Missouri State Parks – a division of the Missouri Department of Natural Resources

(Top) The entrance to the trailhead is located at the southeast corner of Trail of Tears State Park in Cape Girardeau County. DNR photo by Ben Nickelson

(Above Right) The trail traverses a distinctive, Appalachian-type forest.

(Right) An interpreter points out fungi growing along the trail.



DNR photo by Ben Nickelson



DNR photo by Tom Uhlenbrock

Rock Matters

Magnetite is one of several prominent iron oxide minerals found in Missouri. These minerals are composed of the elements iron and oxygen. Large magnetite deposits in Missouri are found in the southeast part of the state and are related to igneous rocks that are approximately 1.4 billion years old.

Magnetite's composition is Fe_3O_4 , making it the richest of the iron oxide ore minerals. Magnetite, as is implied by its name, is magnetic. It will attract a magnet, but does not act as a magnet itself. Naturally magnetized magnetite, called a lodestone, will act as a magnet, and was used for the first compasses. Another important iron oxide mineral found in Missouri is hematite, with a composition of Fe_2O_3 . Hematite often looks similar to magnetite but is not magnetic and will be red when powdered, unlike magnetite, which makes a black-colored powder. Most magnetite in Missouri is very fine grained and massive in character.

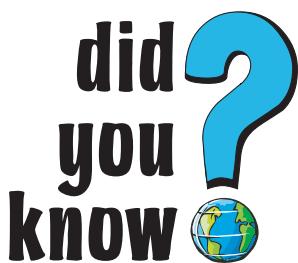
Missouri has a long history of magnetite and hematite mining. The Iron Mountain Mine was first recorded in a land grant in 1797, with mining of the two minerals beginning in the 1830s. The mine operated continuously until 1966, with over 130 years of ore production. The mine site continues to produce crushed igneous rock for numerous industrial uses, making it the longest continually mined property in the United States. Other historic mining included magnetite veins on Shepherd Mountain (1815) and the Pilot Knob surface hematite mine (1835-1920s), both located in Iron County. More recent mining of magnetite occurred from 1964-2001 at the Pea Ridge Mine (Washington County) and from 1967 to 1980 at the Pilot Knob underground mine (Iron County).

Historical iron mines in Missouri strongly affected settlement and development of parts of southeast Missouri. The towns of Iron Mountain, Pilot Knob and Ironton were all settled by miners working the iron mines. The Iron Mountain and Pilot Knob surface mines led to construction of the St. Louis and Iron Mountain Railroad, completed in 1858. It eventually became the Missouri Pacific Railroad, one of the nation's major rail systems.

Although no iron currently is being produced in Missouri, the state contains significant reserves of high quality magnetite ores. Some of this magnetite is what is known as high-quality, high-purity magnetite. While most associate iron with steel girders in buildings or car body frames, it may surprise many to know of the diverse uses for high-purity iron ores. These uses include water purification systems, "green" air emission catalysts, radiation shielding, coal desulfurization and densification of concrete for structures requiring extra strength, such as bridge pillars in rivers. Iron oxide minerals are very stable and nontoxic, and when powdered are used as pigments in everyday items as varied as coloring in decorative concrete to many cosmetic items, including powdered magnetite as a black pigment in mascara.



This magnetite sample is a rare example of magnetite crystals from the Iron Mountain Mine in St. Francois County. DNR photo by Hylan Beyler



Fall is Considered "Burn Season"

Open burning releases pollutants directly into the air, not through a smokestack or chimney. Smoke from open burning can cause eye and lung irritation, headaches, dizziness, coughing, asthma and even death. Missouri allows open burning of residential waste, with exceptions, and local governments often have their own restrictions.

State law permits open burning of residential waste on properties with four or fewer households – except for apartment buildings and mobile home parks – provided that it is generated and burned on the same property. Regulations exclude tires, carpets, plastics, appliances, used oil and remodeling materials, but they do permit yard waste and agricultural burning, except for botanical nurseries and greenhouses. Campfires containing only vegetation, woody materials and/or untreated wood products are allowed.

Open burning beyond the above allowances requires a burn permit from the Missouri Department of Natural Resources. All businesses need a permit.

Before conducting any open burning, contact local regulators or the nearest Department of Natural Resources regional office, especially if you live in a metropolitan area. State law prohibits open burning that creates a health hazard, constitutes a nuisance, or impairs visibility for pilots or motorists. The department discourages open burning without investigating alternatives, such as recycling and waste disposal services. For more information visit dnr.mo.gov/pubs/pub2047.htm.



... but not least

SINKHOLES IN MISSOURI

State Has 16,000 – Fourth in Nation

by Hylan Beydler



DNR file photo

Missouri ranks fourth behind Florida, Texas and Alabama among states where the most damage from sinkholes occur, according to the U.S. Geological Survey.

"Sinkholes exist in many counties in Missouri because much of the state is underlain by limestone bedrock," said Carey Bridges, Geological Survey program director with the Department of Natural Resources' Missouri Geological Survey.

Karst topography – a landscape created by dissolving sedimentary rock such as limestone – also includes caves, springs and losing streams. Water moving through tiny cracks in limestone and dolomite slowly dissolves the rock and carries it away. Typically, sinkholes form so slowly little change is noticeable, but they

can form suddenly.

Sinkholes can act as conduits for rapid surface water infiltration, possibly resulting in groundwater contamination in the area.

"They range in size from several square yards to hundreds of acres and may be very shallow or hundreds of feet deep," Bridges said.

Avoiding and identifying the formation of some sinkholes is possible. There are many surface-related features that could mean there are underground voids. Rapid infiltration of runoff, extreme settling of structures and dying vegetation may be indicators.

Many ground collapses, especially those occurring in urban areas, are due to human activity and are not considered karst related. Construction and drilling activities increase loading

on topsoil and can lead to settling. Broken underground water pipes allow water to carry away soil surrounding the pipes and can lead to surface collapse.

The Department of Natural Resources provides assistance to evaluate the causes and impacts of sinkholes, and performs geologic and hydrologic evaluation to determine if collapse is attributed to natural or man-made causes.

Learn more and create a map showing known sinkholes at dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm.

Hylan Beydler is division information officer for the Missouri Geological Survey, a division of the Missouri Department of Natural Resources.

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[100missourimiles.com!](http://100missourimiles.com)

